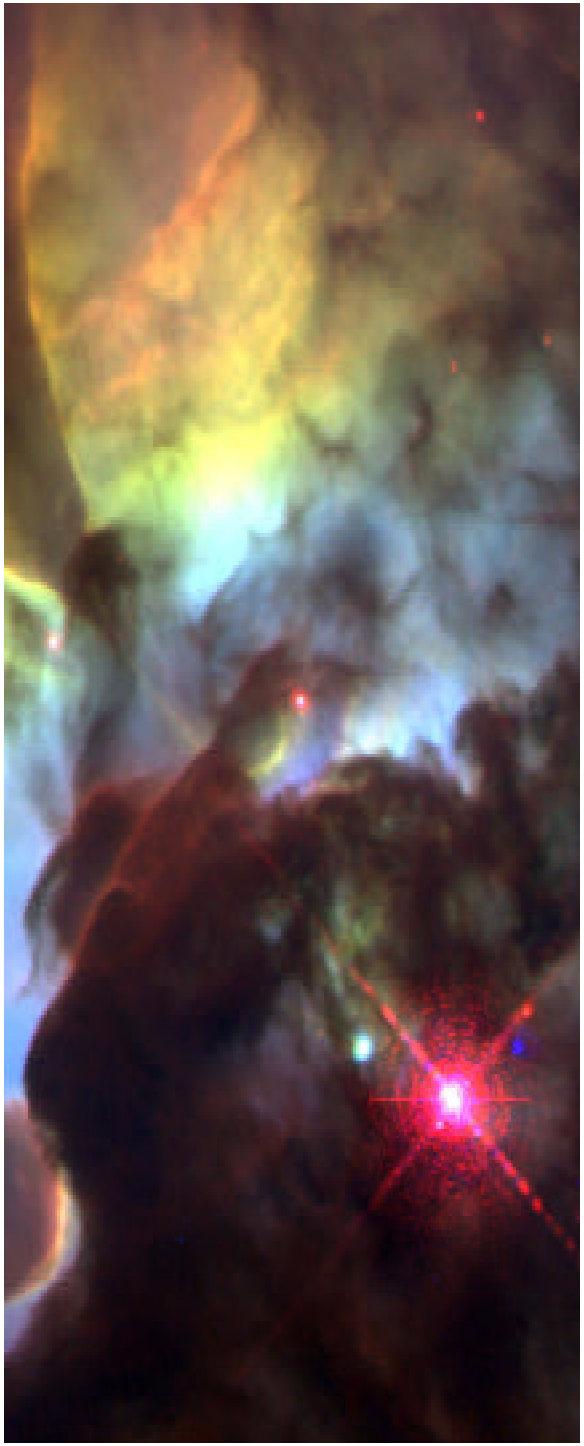
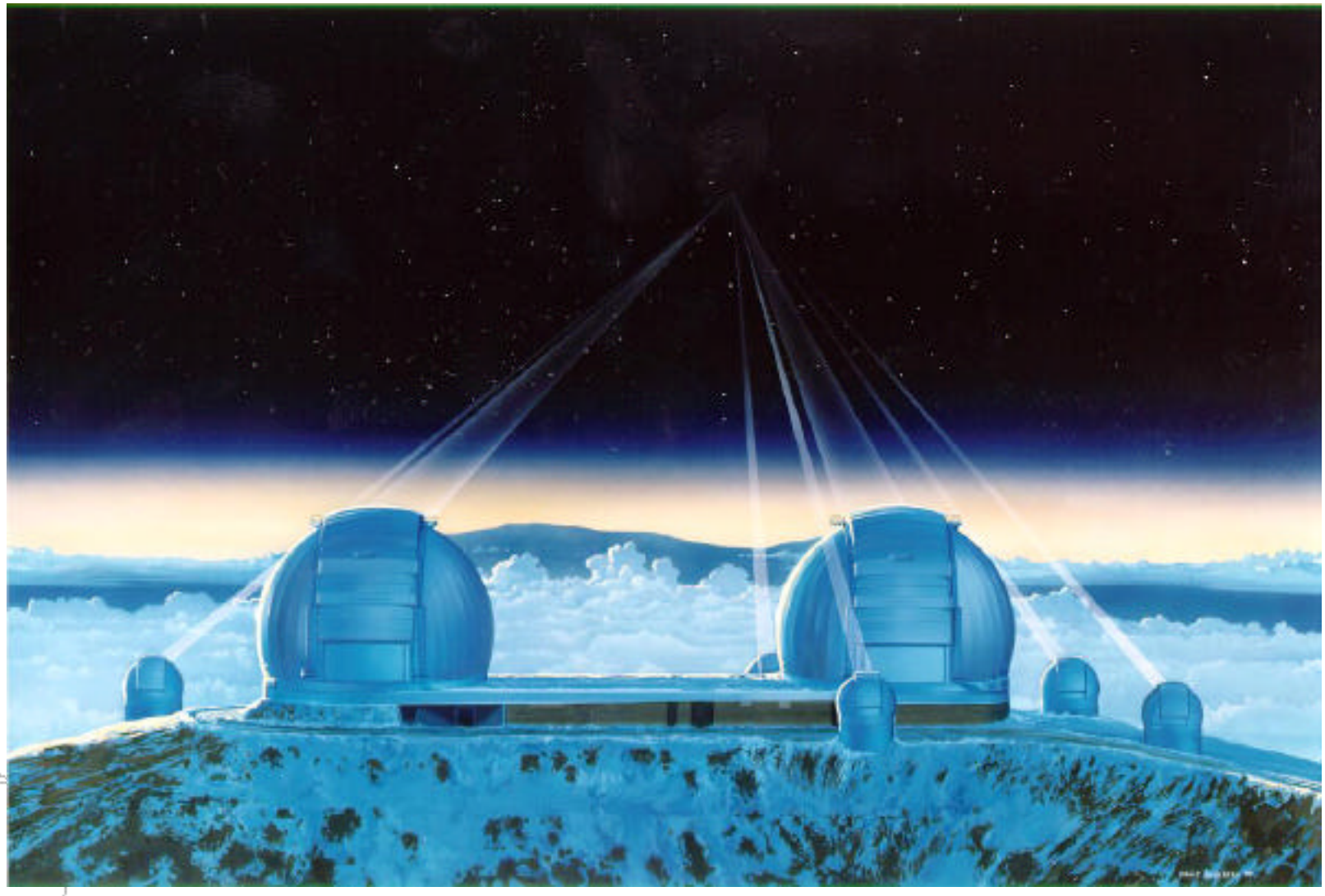


Keck Interferometer

Presented by

Paul Swanson
Project Manager

Keck Interferometer Array



Interferometer

KECK

A NASA Origins Mission

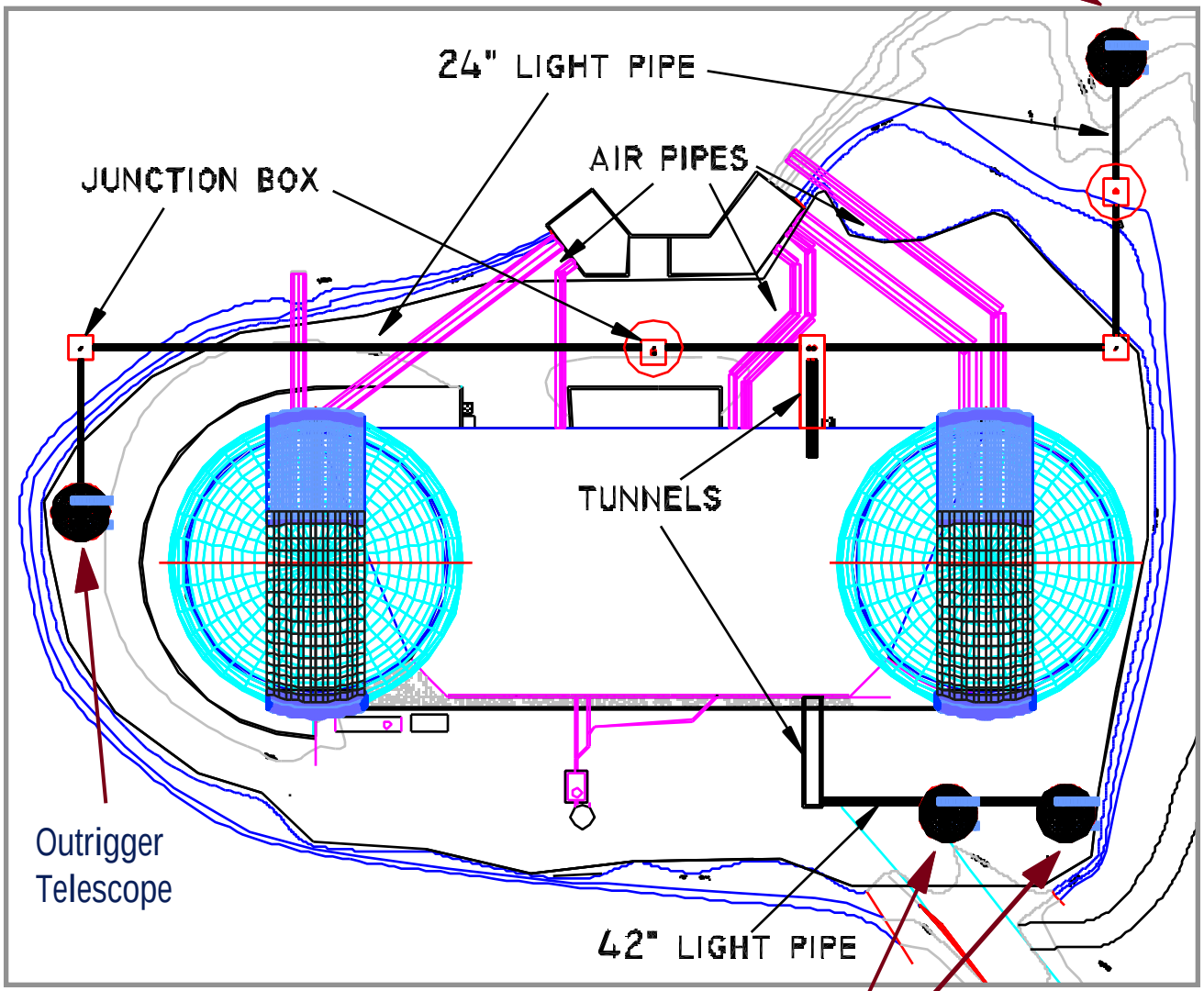
Science Objectives

- Detect exo-zodiacal emission around nearby stars at 10 μm
  - Measurement down to 10 solar zodi
  - Necessary information for Terrestrial Planet Finder design
  - Uses two Kecks only
- Direct detection of warm, giant planets and brown dwarfs using two-color, differential-phase techniques
  - Uses two Kecks only
- Astrometric detection of Uranus-mass planets to 20 pc
  - Astrometric accuracy of 20 microarcsecon
  - Using outriggers only
- Synthesis imaging with 3 milliarcsecond resolution @ λ=2 μm
  - Using two Kecks plus four outriggers

Performance

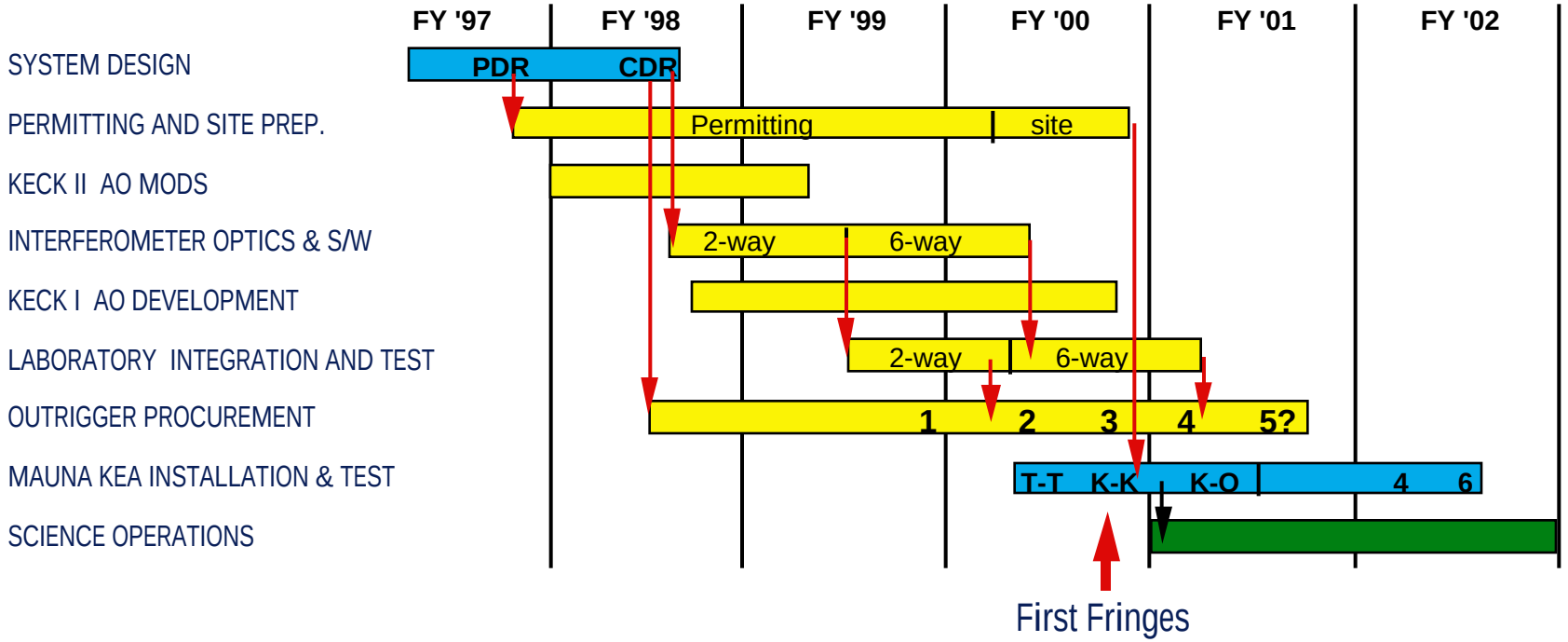
- Imaging angular resolution
  - @ λ=10 microns - 15 milliarcseconds
  - @ λ= 2 microns - 3 milliarcseconds
  - 10 times better than a single 10m Keck
- Differential astrometry angular resolution
  - 20 micro arcseconds
  - Can detect 5 cm. motion at distance of Moon
- Sensitivity
  - 21.8 mag @ 2.2 μm in 500 seconds
  - 11.6 mag @ 10 μm in 500 seconds

Mauna Kea Site Layout



Two Outrigger Telescopes and the
Location of Initial 40 cm Test Siderostats

Development Schedule



“Phase A” Activities

- Initiated “Phase A” with system trades/optimization
- Goal is to optimize science return within the allocated $50M
- Two major issues to fit within the $50M budget
  - Number and size of the outrigger telescopes
    - Considered six, 2.0 m, movable outriggers
    - Baseline is now four, 1.8 m, fixed outriggers (with pads for six)
  - Scope and timing of the operations and Science Data Center
- Defined operations policy (ownership, time allocation, etc.)
- Developed Keck science operations plan and costs
- CARA to operate Interferometer using experience and infrastructure already in place
  - New facilities needed
  - Negotiating with CARA for roles and responsibilities
- Not all issues resolved
  - Operations and Science Data Center still a lien against the budget
  - Various cost reduction options are still being worked

Key Activities Last Year

- Started detailed subsystem designs
- Held Preliminary Design Review (PDR)
- Survey of Keck site
- Vibration analysis of Keck telescopes
- Prepared documents for site permits
- Defined test siderostats for initial operation
- Sent out outrigger specifications & RFP package
- New implementation plan and costing for KIA
- Completed project documents:
  - Program plan
  - Project Implementation Plan
  - Science requirements documents
  - Several subsystem requirements documents

Operations Philosophy

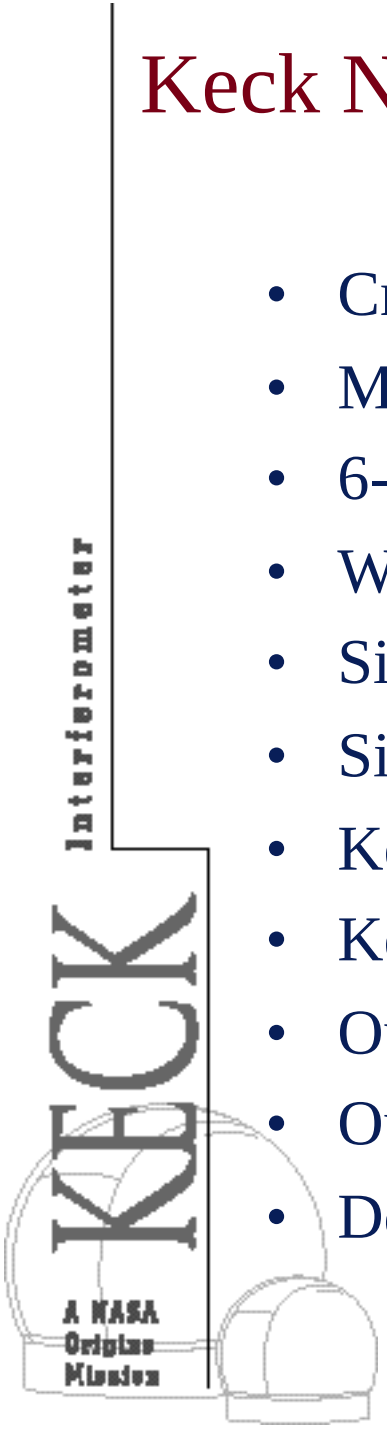
- Observing mode will be service observing
- Formal observing to start in 2003 (limited observing in 2002)
- Early (2001) science operations will aid system debugging
- Initial observing will be Key Science Projects
  - Selected by peer review (FY '99 NRA)
    - Exo-zodiacal measurement (2001)
    - Direct detection of "super Jupiters" (2001)
    - Search for Uranus-mass planets by astrometry (2003)
- Guest Investigator program will gradually replace Key Science Program (>2003)
- Science Data Center
  - At IPAC
  - PI support, data processing and archiving
  - Needed in 2000 for end-to-end system tests

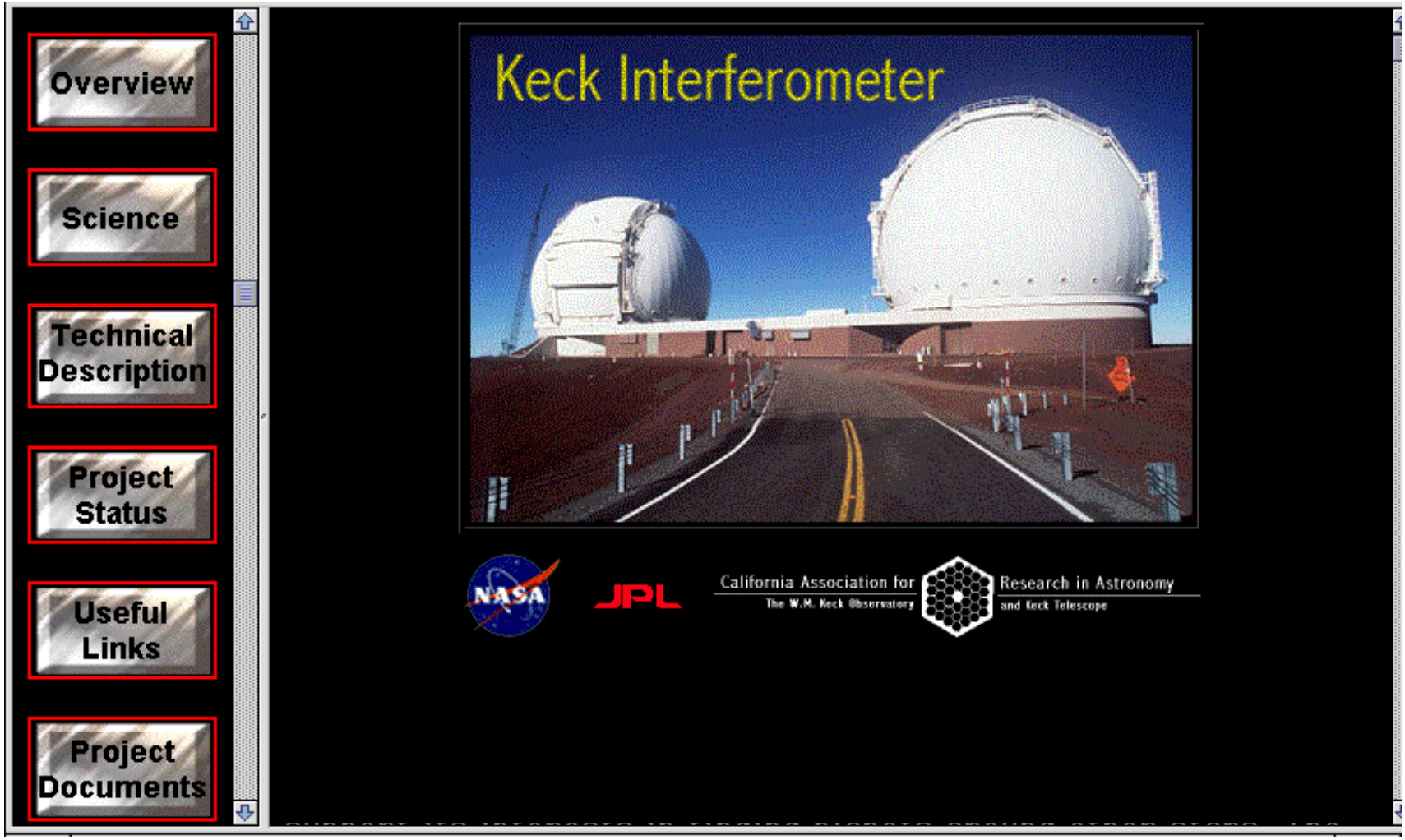
Permitting

- Siderostats
  - Siderostat request submitted to Hawaii Office of Environmental Quality Control March 2, 1998
    - Finding of no significant impact
  - Environmental Assessment submitted to NASA March 16
    - Accepted by NASA with minor editorial changes
  - Hawaii Historical Society has determined that no historical sites are affected
  - Final construction approval expected by May 1998
- Outriggers
  - Outrigger description and specification complete
  - Management audit of University of Hawaii published
  - New Mauna Kea master plan to include Keck Interferometer
  - Approval for outriggers expected in 18-24 months

Keck Next Year

- Critical Design Review completed
- Much of 2-way combining optics completed
- 6-way design complete
- Work started on 6-way beam combiner
- Site construction for siderostats complete
- Siderostats starting to be installed on mountain
- Keck II AO modifications complete
- Keck I AO nearing completion
- Outrigger contract in place
- Outrigger #1 about 50% complete
- Dome #1 about 50% complete





KECK Interferometer

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For more information about the Keck Interferometer, visit our website:

http://huey.jpl.nasa.gov/keck/